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Agricultural Experiment Station

BULLETIN No. 136

METHODS OF SEEDING OATS, DRILLING AND BROADCASTING

By ALBERT N. HUME, O. D. CENTER and LEONARD HEGNAUER

URBANA, ILLINOIS, JULY, 1909

Summary of Bulletin No. 136

With the least possible amount of work in preparing the seed bed and sowing the grain, the average yield of oats in Illinois, sold at the average price per bushel, will not pay the cost of production and 5% interest on land worth $100 per acre. If better methods of preparation and sowing are practiced, and if the plant food which is removed in the crop is accounted for, the average yield per acre, sold at the average price per bushel, will only pay interest on $60 land. Page 299

The use of the disk drill as a means of seeding oats is one of the evident means of increasing the yield per acre. Page 301

The results of three years trials at Urbana show that a net gain of 5.3 bushels per acre more oats were secured from drilled than from broadcast seeding. Page 302

Three years' work at De Kalb indicate a general average yield in favor of seeding oats with the drill rather than sowing broadcast. Page 303

Less seed per acre is required where oats are seeded with the drill than where seeded broadcast. Page 303

The general average of two years' trials on the Sibley field, regardless of the kind of preparation of the seed bed before sowing, shows a net gain of 3.6 bushels of oats per acre where the oats were drilled over those broadcast. Page 305

The cost of seeding oats with the drill is no greater than the cost of seeding broadcast. Page 307

Regularity of stand, evenness of growth, and uniformity of ripening is secured more completely with drilled than with broadcast seeding. Page 310

It is a matter of observation that clover seeded with oats sown with the drill is less liable to be killed shortly after harvest than clover seeded with oats sown broadcast. Page 310

This bulletin will be sent free of charge to any one interested in Illinois agriculture upon request to E. Davenport, Director, Agricultural Experiment Station, Urbana, Illinois.

METHOD OF SEEDING OATS, DRILLING AND BROADCASTING

By ALBERT N. HUME, Associate in Crop Production,
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Illinois produces annually 112,200,000 bushels of oats from 3.4 million acres, an average of 33 bushels per acre. The oats sold in the market bring an average price of 32.2 cents per bushel, and it costs the average farmer at least 16 cents per bushel to produce oats, when the yield is only 33 bushels per acre. Illinois must produce a larger yield per acre if oats are to remain a profitable crop. It costs not less than $5.45 per acre to produce oats, taking a ten-year average and using conservative figures in the computations. This cost considers the minimum amount of preparation and work involved in growing the crop. The items considered are, the sowing, with a broadcast seeder, the seed, disking once, harrowing twice, harvesting, including the twine used, and the shocking, threshing, and marketing. The average yield per acre, and price per bushel given above, show that $5.17 is the gross profit received. This gross profit will not pay the taxes and 5 percent interest on $100 land.

It must be kept in mind, however, that in the cost per acre of production, we consider the minimum amount of labor, make no allowance for wear of machinery and, what is much more important, have wholly disregarded the plant food which we remove in the crop, and which we must replace if the land is to remain productive to its present degree. When these items of cost are considered, the gross profit is reduced to $3.33, which amount will pay taxes and 5 percent interest on only $60 land.

Except then for the fact that the oats of this state are commonly raised as needed in rotation with corn, the crop cannot be called a profitable one.

There is proportionally as much possibility for improvement in the oat crop, as there has been and is in the corn crop of Illinois.

A large proportion of the farms in the corn belt of the state are capable of producing 75 bushels of oats per acre. Farms that average 75 bushels per acre from land in oats have made a profit of more than 20 cents per bushel, or more than $15 per acre, which is certainly a more business-like profit than the average, and this moreover places the oat crop among the profitable crops for Illinois farmers to grow. Illinois farmers should continue to hope, and strive, to raise at least 75 bushels of oats per acre as an average.

URBANA FIELD—1905—PLAN OF OAT PLOTS

161		Drilled Broadcast	Sixty Day
162		Drilled Broadcast	Prize Cluster
163	Standard	Drilled Broadcast	Silvermine
164		Drilled Broadcast	Black Gotham
165		Drilled Broadcast	Siberian
166	Standard	Drilled Broadcast	Silvermine
167		Drilled Broadcast	Lincoln
168		Drilled Broadcast	American Banner
169	Standard Soil plot	Drilled Broadcast	Silvermine
170	Standard Soil plot	Drilled Broadcast	Silvermine
171		Drilled Broadcast	Twentieth Century
172		Drilled Broadcast	Irish Victor
173	Standard	Drilled Broadcast	Silvermine
174		Drilled Broadcast	Waverly
175		Drilled Broadcast	Danish White
176	Standard	Drilled Broadcast	Silvermine
177		Drilled Broadcast	White Bonanza
178		Drilled Broadcast	Schönen

It is not the purpose of this bulletin to review all the factors that may enter into the production of more profitable crops of oats, but only to compare two common methods of seeding. Perhaps the most obvious way to get some immediate increase in yield from land in oats is to employ the drill instead of continuing to use the more common

broadcast seeder. In support of this opinion we give experimental data secured in this state from three different crop experiment fields.

EXPERIMENTS AT URBANA

Experiments with drilling and broadcasting of oats at Urbana have been conducted three separate years in connection with the regular variety test plots. Each of the three years, half of each variety plot has been drilled and half broadcasted. The sowing on both halves of the plots has been done with the same disk drill, the broadcasting being done by taking the lower ends of the grain spouts out of their places, and by directing the open end forward, letting them scatter the oats in front of the disks instead of exactly in the track of the disks. Thus the process was practically the same as the usual one of broadcasting the seed and disking afterward, and it was also comparable to drilling on the other half of the plot, the seed having been put on with the same machine, doing the same amount of work.

The plan of the variety plots for 1905, given on page 300, will illustrate the plan of the plots for the three years of the experiments at Urbana. It may be remembered that the varieties are different on all plots except the standard plots, which are always put in with a single variety. For the present experiment the matter of varieties is not considered. The plan is intended to show that the north half of every plot was drilled and the south half of every plot broadcasted. The names of the varieties grown on these plots in 1905 is also shown. While these varieties were practically the same for every year of the experiment recorded, their relative position in the series of plots and in regard to each other, was not the same during the three years of the experiments.

This same plan will not only serve to illustrate the manner of conducting the experiment in 1905, 1907 and 1908 at Urbana, but also at the De Kalb field in 1906, 1907 and 1908.

In Table 1 one of the most noteworthy features is that the relative effect of drilling and broadcasting varies greatly with seasonal conditions. Thus in the year 1905 without any exception the drilled half of each of the 18 plots yielded more bushels per acre than the broadcast half, the average difference being 12 bushels in favor of drilling. In 1907 the drilled oats yielded more in 11 instances, in 2 of the remaining ones the drilled and broadcast halves of the plots yielded exactly the same, and in the remaining 5 cases out of the 18, the broadcast halves yielded more than the drilled. In the year 1908 more plots were used in the experiment than formerly. Furthermore, instead of sowing equal amounts of seed on the drilled and broadcast halves as was done in 1905 and 1907, the machine was set to sow 2 bushels per acre on the drilled and 3 bushels per acre on the broadcast halves. This was done with the thought that the increased amount of seed might increase the yield sufficiently to compensate for the difference, if any, caused by drilling. The actual yield of the drilled halves of the plots was more than the broadcast in 18 instances out of 30, exactly the same in 3 instances, and less than the broadcast halves in the remaining 9 instances. The actual average yield of the 30 plots

was 1.6 bushels per acre greater on the drilled halves than on the broadcast halves. Adding to this 1 bushel per acre of seed oats saved on the drilled halves, the difference in favor of drilling in 1908 at Urbana, is made 2.6 bushels per acre. As an average of all plots for the three years the gain in favor of drilling at Urbana, was 5.3 bushels per acre.

The following table summarizes the three years of tests conducted at Urbana. Results for the year 1906 are not given, owing to the fact that the test was not included that year.

TABLE 1. YIELDS OF OATS, URBANA FIELD, 1905, 1907, 1908

Methods of Seeding—Drilled and Broadcast

Plot No.	Yield in bushels per acre					
	1905		1907		1908	
	Drilled	Broadcast	Drilled	Broadcast	Drilled	Broadcast
1	56 9	48.1	67.1	52.8	48.8	40.6
2	43.5	39.5	28.1	27.5	30.6	28.4
3	63.0	51.9	37.2	33.7	36.9	23.1
4	59.0	47.4	34.7	32.2	28.4	31.6
5	68.2	56.0	34.7	35.9	35.6	31.2
6	71.6	50.2	35.6	34.4	27.2	26.2
7	63.6	48.1	30.0	29.6	26.9	25.9
8	56.7	40.9	31.5	35.0	33.7	36.9
9	53.3	45.4	32.5	33.7	32.5	30.6
10	57.0	47.4	33.4	32.2	30.0	30.0
11	53.3	48.5	26.3	30.0	30.3	30.0
12	58.4	47.8	27.2	28.7	25.3	27.5
13	62.7	56.4	36.0	33.0	31.5	27.5
14	61.0	45.4	33.7	28 7	25.0	28.4
15	62 9	53.3	32 2	30.9	31 5	30.3
16	67.0	56.7	33.4	33 4	28.7	27.2
17	75.6	52.2	30.9	30.9	19.4	16.2
18	71.0	53.3	30 0	29.7	16.9	17.2
21					42.5	34.0
22					31.8	28.7
23					16.6	17.5
24					17.8	18.3
25					26.2	21.8
26					27.1	26.2
27					26.2	23.7
28					18.7	18.7
29					16.8	18.7
30					28.1	28.1
31					24.7	22.2
32					19.7	20.9
Average	61.3	49.3	34.1	32.9	27.3	25.7
Gain for drilled	12.0		1.2		2 6*	

*Including 1 bushel saved in seed.

Net average in favor of drilled, 5.3 bushels.

EXPERIMENTS AT DE KALB

As has been stated, the general plan of variety tests at the De Kalb field is the same as that at Urbana. The experiments with methods of seeding of oats have been conducted at that field three separate years. In 1906, when the plots were all necessarily plowed out of timothy sod in the late spring, the plan was to prepare the land as well as possible by disking and harrowing and to drill every other plot and broadcast the alternate ones. In 1907 and 1908 the same plan was followed as on the Urbana field, viz., that of drilling half of each plot and broadcasting the other half.

At De Kalb, as at Urbana, the drilling was done with a disk drill, and the broadcasting was done by arranging the drill spouts so they might deliver the seed in front of the disks instead of directly into their tracks. Also this work at De Kalb, as well as at Urbana, was done in connection with the usual variety tests.

Conditions of soil and climate at the De Kalb field during the three years were not the most favorable. In 1906 the field on which the tests were made was not secured until winter, so the ground for oats was plowed out of timothy sod in the spring; thus making it difficult to secure the best seed bed for the oats. The season at De Kalb in 1907, as well as at Urbana, was more than usually wet. Theoretically, the surplus of rain would favor the yield of broadcast oats at both places for the season of 1907. It is well known that the season of 1908 was also an unfavorable one for oats thruout almost our entire state.

At the De Kalb field in 1906 the difference was 4 bushels per acre; and in 1907 it was 3.2 bushels per acre, in favor of drilling. In 1906, in 8 instances out of a total of 10, where the pairs of plots were comparable, the yield of drilled oats was larger; in 1 instance it was the same as the broadcast; and in the 1 remaining instance the yield was 0.7 bushel in favor of broadcast oats. In 1907, 35 plots were sowed with different varieties, and half of each was drilled and half broadcast. In 31 instances out of the 35, the drilled halves of the plots yielded more than the broadcast; in the 4 remaining instances the broadcast halves of the plots yielded most.

In 1908 at De Kalb 10 one-fifth acre plots were employed in this trial, one half of each plot being drilled and one half being broadcast. Five of the plots yielded more bushels per acre on the drilled halves, and the other 5 yielded more on the broadcast halves. The actual average yield for the two methods of seeding was the same to 0.1 bushel. It should be stated, however, that the drilled halves were seeded at the rate of 1.5 bushels per acre, which is probably more favorable to the clover growing in the oats, than for a maximum yield of oats (See Illinois Experiment Station Bulletin 41); while the broadcast halves were seeded at the rate of 2½ bushels per acre. In calculating the net gain in favor of the drill the 1 bushel per acre which was saved in the seed on drilled halves, is added to the results for that method of seeding; this gives a net difference of 1 bushel

per acre in favor of seeding with a drill in 1908, at De Kalb. At the foot of Table 2 is given the net general average yield in favor of seeding with a drill, which for the three years is 2.7 bushels per acre.

The following table summarizes results from the De Kalb field.

TABLE 2. YIELDS OF OATS, DEKALB, 1906, 1907, 1908 — Methods of Seeding—Drilled and Broadcast

Plot No.	Yield in bushels per acre					
	1906		1907		1908	
	Drilled	Broadcast	Drilled	Broadcast	Drilled	Broadcast
1	19.5	18.4	26.6	23.1	36.6	32.5
2	16.8	14 9	28 7	27.5	28.1	37.2
3	16.3	16.3	32.2	31.6	39.7	37.5
4	21.2	19.1	28.7	30.6	43.4	35.3
5	29.1	24.5	30.6	26.9	33.4	45.0
6	26 1	21.2	30.9	24.7	51 9	38.1
7	27.1	24.7	38.1	25.9	47.8	54.1
8	21 9	22.6	35.0	25.6	42.2	37.2
9	32.7	17.7	30.9	27.2	43.4	43.7
10	27.3	18.9	33.7	32.2	34.4	40.9
11			27.8	26.2		
12			30.0	26.2		
13			26.9	29.1		
14			27.2	34.1		
15			31 2	26.6		
16			29.7	24.7		
17			38.4	34.1		
18			30.6	26.8		
21			21.9	23.1		
22			30.6	29.4		
23			29.4	26 2		
24			32.5	31.9		
25			37.5	33.7		
26			32.5	27.5		
27			36.9	31.2		
28			35.0	31.9		
29			36 2	31.2		
30			36.2	33.7		
31			33.1	31.2		
32			40.0	38.1		
33			33.1	27.5		
34			37.5	32.5		
35			35.6	34.4		
36			33.1	30.0		
37			43.1	34 4		
Average	23.8	19.8	32.6	29.4	40.1	40.1
Gain for drilled	4.0		3.2		1.0*	

*In seed saved.

General net average in favor of drilled, 2.7 bushels.

EXPERIMENTS AT SIBLEY

At Sibley, in Ford County, in the two seasons, 1906 and 1907, a series of oat plots were arranged which were designed to furnish rather direct comparison between drilling and broadcasting. The outline in Table 3 is self-explanatory. It shows the general plan of these oat plots at Sibley. The field was divided into 4 parts, each part duplicating the others, with the exception that different varieties were used on the different parts. From this plan it may be seen that plots 1 to 6 are duplicates of plots 11 to 16, 21 to 26, and 31 to 36. Previous to being put into oats in 1906 this land had been in corn, and clover had been seeded on the land at the last cultivation of the corn.

The following table summarizes the yields of oats from these different plots at Sibley for the two years, 1906 and 1907.

TABLE 3. YIELD OF OATS, SIBLEY FIELD, 1906, 1907
(Bushels per acre)
Methods of Seeding—Drilled and Broadcast

Manner of preparing and sowing	Plot No.	Yields of plots		Ave. yield of plots each year		Ave. for two years
		1906	1907	1906	1907	
Broadcast, disk, and harrow	1	41.4	15.0	37.0	20 2	28.6
	11	49.8	22.2			
	21	31.9	23.5			
	31	25.0	?			
Disk and drill	2	36.6	26 3	35.0	27.6	31.3
	12	32.6	25 3			
	22	31 5	31.2			
	32	39.3	?			
Disk, broadcast, disk, and harrow	3	31.4	15.3	36.3	21.3	28.8
	13	35.9	20.8			
	23	42.1	20.3			
	33	35.7	29.0			
Disk, drill, and harrow	4	35.7	25.6	37.9	27.1	32.5
	14	43.7	25.8			
	24	34.3	28.0			
	34	?	29.0			
Plow, broadcast, and harrow	6	47.9	25.1	40.6	22.8	31.7
	16	40.3	22.2			
	26	42.1	19.0			
	36	32.1	25.0			
Plow and drill	5	52.8	25.0	48.6	23.9	36.2
	15	53.2	23.0			
	25	55.3	23.5			
	35	33.2	24.0			
Average of all drilled plots				40.5	26.2	33.3
Average of all broadcast plots				38.0	21.4	29 7
Gain for drilled				2.5	4.8	3.6

It should be stated in this connection that the plots that were not plowed for oats showed a very marked growth of this clover in the oats in the summer of 1906. Unquestionably, this growth of clover diminished the yield of oats on such plots. In 1907, the arrangement of plots for this experiment was exactly the same as in 1906. The series of plots was laid out in the same 40 acres, tho not on the same land.

A little computation with the preceding table shows us that on all plots plowed before seeding, the difference in yield in favor of drilled oats was 4.5 bushels per acre. In the case of all plots that were only disked before or after seeding, the average in favor of drilling was 2.5 bushels per acre. This would indicate that plowing does not take the place of the use of the drill; in fact, drilling seems to be even more advantageous on plowed land than on land only disked before seeding.

As before noted the growth of clover on the unplowed plots in 1906 was very pronounced. It may be questioned whether an increase of 2 bushels of oats per acre is sufficient to pay for the labor involved in plowing, rather than disking, before drilling. In any case where clover may have been seeded in the corn the year previously and have made any marked growth, or in any case where the land is very weedy, even tho it may not be necessary to plow land for oats for the purpose of securing a better seed bed, it is desirable to plow in order to remove the clover, or weeds, from competing with the oats, and thus lowering the yield.

In 1907, because of rainfall, it was impossible on plots 1, 11 and 21, to harrow the oats immediately after broadcasting them, so they lay on the surface of the ground from March 26 till April 3, when the plots were harrowed. It is obvious that this may have reduced the yield of these broadcast plots. Nevertheless the conditions of the experiment at Sibley were those that often arise in practical farm operations. They illustrate the more forcibly one of the advantages in the use of drills.

We have then on 3 fields, fairly representing the entire area of oat production of Illinois, a significant showing in favor of sowing oats with the drill. At Urbana this was 5.3 bushels per acre, at De Kalb it was 2.7 bushels, and at Sibley it was 3.6 bushels per acre. These averages are taken upon the supposition that the averages in favor of drilling for each year may receive equal weight. By taking into account the number of years included in the trials at each field and taking a weighted general average of these averages, we find 3.9 bushels per acre more for drilling than for broadcasting. It is interesting to observe that a difference of 3.9 bushels per acre over the entire area of 3.4 million acres of oats land in Illinois is a matter of over 13 millions bushels of oats annually. At the average farm price of oats cited on page 299, this means more than $4,000,000, which may be taken as fairly representing the possible increase to the state.

COST OF SEEDING BY THE TWO METHODS

By inspecting Table 3, we have found that the difference in favor of drilling is even greater on plowed plots than on those prepared by any other method. This is not sufficient to lead to the general conclusion that oat ground must always be plowed, but it certainly indicates that the seed bed should be well prepared by one method or another. In reckoning then the cost of sowing by each method, we may assume that the same amount of work will be put upon preparation of the seed bed for sowing for each of the two methods.

The difference in cost then of sowing by the two methods must lie in the difference in amount of labor it takes to actually put on the seed and cover it. It has been suggested that the annual cost entailed by wear upon drilling machinery is scarcely appreciable. With good care a drill should not cost over $2.50 to $5.00 per year, depending upon size of drill and amount of land sowed.

It is found from the Station's experiments and from the experience of careful farmers that going once over the land with a broadcast seeder, and once with a harrow, will take as much time and labor as once going over it with a drill. This would certainly represent the minimum of work that could be done in each case. If, besides this, the broadcast land needs to be disked, while the disk-drilled land needs only to be harrowed, the drilled land would require less expense. We may reasonably hold that it is at least as cheap to drill oats as to broadcast and then cover the seed, and that whatever increase in yield is secured by drilling is clear gain. That this will hold good in actual practice is affirmed by a number of successful farmers in Illinois who have used drills.

The question will likely arise as to what kind of drill to use. To this it is only necessary to reply, that the only practical kind for corn belt farmers is some good make of disk drill. The disk drill is the only kind we know that will not clog in going thru an ordinary amount of corn stalks or other refuse on land. A good disk drill will do this without much trouble. Perhaps the disks should be 8 inches apart rather than closer together for this mechanical reason.

RESULTS FROM OTHER SOURCES

The longest continued experiments on methods of seeding oats we are able to quote were conducted at the Kansas Experiment Station. The work is reported in Kansas Bulletin No. 74. Plots were seeded each year broadcast; others with a hoe drill, others with a shoe drill with press wheels, and others with a shoe drill without press wheels. For present purposes it is sufficient to say that as an average for seven years the lowest yielding plots were those sown broadcast, the actual average being 26.2 bushels per acre. The highest yield was secured by sowing with the shoe drill without press wheels, 31.5 bushels per acre being the average by that method. This shows a difference of 5.3 bushels in favor of drilling.

At the Ontario Agricultural College Experiment Station Farm at Guelph, Canada, drilling and broadcasting oats were compared in three separate seasons, according to a summary of results given in the annual report of that Farm for 1898. Six plots were drilled and 6 broadcast each year. The work of broadcasting was done by hand. "Without a single exception, oats sown with a grain drill on 6 different plots for three years in succession gave a larger yield of grain per acre than those broadcast by hand." The summary of averages for three years shows that the average yield of broadcast oats was 48 bushels per acre, and of drilled oats was 52 bushels per acre, 4 bushels per acre in favor of drilling.

In Bulletin 96 of the Iowa Experiment Station the question of drilled *vs.* broadcast oats is discussed. The Iowa Experiment Station recommends that "when oats are sown broadcast instead of drilled, a heavier seeding is desirable, as much of the seed remains uncovered or at best is only shallowly buried and thus fails to sprout until several days late. This produces a field that is spotted all through the season. It has been held that drilling is not a very important factor with the oat crop, but it is evident that the drill not only saves seed but also increases the yield."

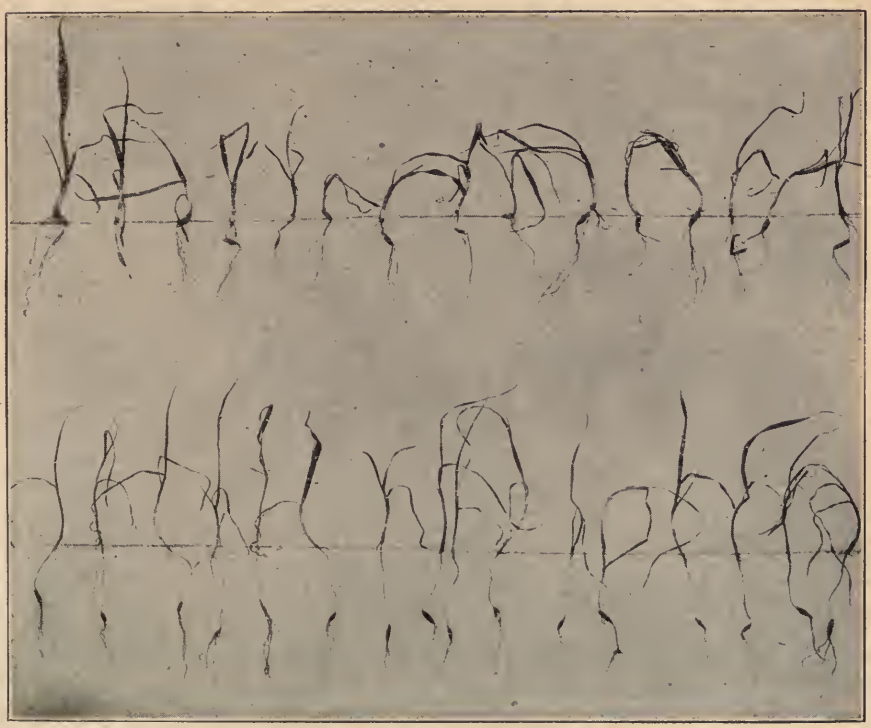
In addition to the above the Iowa Station gives the results with two varieties of oats each seeded both drilled and broadcast at the uniform rate of 2½ bushels per acre.

The average shows a yield of 44.9 bushels per acre which tested 23½ pounds per bushel where the oats were drilled, while an average of 35.3 bushels per acre of oats testing 21½ pounds per bushel was secured from broadcast sowing. While the results given are only for a single season the increase of 9.6 bushels per acre certainly indicates a decided advantage gained in the use of the drill.

CONCLUSIONS

With the data in hand from experiment fields in different parts of our own state, and in view of the fact that these data are so fully in accord with data from Kansas, Canada, and Iowa, there is no question that, as an average, more oats per acre can be secured in Illinois by using the drill method of seeding.

Having once established a fact, it is interesting and profitable to know why it is a fact. A study of the root systems of young oat plants gives us a reason why drilled oats grow much more uniformly and therefore yield more bushels per acre than broadcast oats. The illustration below shows in the upper line young oat plants taken from broadcast seeding. In the lower line we have young plants from drilled oats of the same age.



The line drawn represents the surface of the ground. These oat plants are placed as nearly as possible in the relative position they were in when washed from the soil.

It is instructive to note the plants in the upper half of the illustration and see where the oat grain was found and its position in relation to the surface of the ground. It is also of interest to see the irregularity of depth shown.

In contrast with the upper half of the illustration it is but necessary to note the uniformity of depth of the drilled oats, the similarity of plants and of roots, and the even growth in every particular, to be convinced that the regularity of stand secured, the evenness of growth, the power to stand adverse conditions, and the evenness and uniformity of the ripening of any field of drilled oats is not a matter of opinion but rather an easily explained and established fact.

Many of the plants from the broadcast seeding are in such position as to be easily and quickly affected by freezing weather when they are very young, or by drought even after they have attained considerable size. With nearly all, the root system is decidedly more superficial and from its very position indicates that there will be great dissimilarity in rapidity of growth, time of heading, and time of ripening. When we consider the seed that has been left completely uncovered or is so near the surface as to sprout and then succumb to the adverse but natural climatic conditions that will prevail, we must conclude that the increased yield per acre from the use of the drill is but one of the points of superiority of this method of seeding over that of broadcasting.

It is a matter of observation, that when clover is seeded in oats which are drilled, and which have the drill rows in a north and south direction there is considerably less danger of the young clover being killed by the hot sun as soon as the oats are harvested. It is plain to see that the clover plants receive more direct sunshine when sown as indicated than where the nurse crop is broadcast. The young plants are thus hardened or tempered to the hot sun and therefore do not readily die because of the burning which they undergo when the nurse crop is removed.

Considering then the increased yields per acre secured, the evenness of stand, regularity of growth, uniformity of heading and ripening, smaller amount of seed necessary, and the observed effect upon the clover which may be sown, we cannot but conclude that drilling oats is superior to broadcasting as a method of seeding for average Illinois conditions.

TREATMENT OF OATS FOR SMUT

In our discussion of means of increasing the yields of oats in Illinois, we must not neglect to mention the gain secured by the treatment of the seed oats for smut. The loss from smut in Illinois is much greater than is commonly supposed. The loss is usually underestimated for three reasons.

1. The smutted stalks are usually shorter than the healthy ones and therefore are not observed unless special effort is made to find them.

2. The smutted heads do not always push out of the sheath leaves, so that if these are noticed at all they are merely counted as dwarfed plants.

3. The smut ripens several days earlier than the healthy heads, and, unless the field is examined before cutting, the smutted heads are overlooked since the wind scatters the smut spores and leaves only the bare stalk.

In 1901 the Illinois Experiment Station secured a total of 537 tests representing nearly every section of the state and found that on an average the amount of smut in the oatfields was over 13 percent. Since 1901 the Illinois Experiment Station has made repeated tests with oats, grown side by side on the same general type of soil, the seed on one plot having been treated to destroy the smut spores, while the seed on the next plot was untreated. These tests have shown that 93 percent of all those plots sown with untreated seed had from 1 to 20 percent of the heads smutted. Only 44 percent of the plots sown with treated seed showed any smut at all, and the average amount found on any of these treated plots was 1.2 percent.

The smallest loss in any single season where untreated oats were sown was ¼ bushel per acre, and the largest loss of any season was 13.25 bushels per acre. This loss can all be avoided by treating seed at least every third year by the following method:

Formalin Treatment

Make a solution of 1 pound of concentrated* formalin to 40 gallons of water. Mix thoroly by stirring. Spread a convenient quantity of seed oats to be treated, to a depth of from 3 to 5 inches, upon a tight floor or in a wagon box. With an ordinary sprinkler-pot, sprinkle the formalin solution over all parts of the grain until the top of the pile is quite wet. Stir the pile over with a garden rake or scoop shovel, until the damp oats are thoroly mixed with those on the bottom of the pile. Repeat the sprinkling and stirring until every kernel in the pile is thoroly dampened. Repeat this process until all the seed necessary for sowing has been treated. As soon as one portion is treated shovel into a pile and cover with an old binder canvas, blanket, sacks, or any cloth. Leave covered for at least 12 hours. The oats

* Concentrated formalin is a forty per cent. solution of formaldehyde. It is a clear transparent liquid, resembling water, except that it has a very sharp, pungent, penetrating odor. A concentration of forty per cent. should be insisted on in ordering to be sure of results.

may be treated during the winter, dried, and placed back in the bin, or they may be treated the day previous to the time they are to be sowed. Oats treated by this method require the use of about one half a gallon of the formalin solution per bushel of seed to insure satisfaction. This method of treatment is easy, rapid, requires a small amount of material, does not wet the seed until it is difficult to sow, and is comparatively cheap. Formalin will cost about 40 cents per pound at the drug stores. One pound will make solution enough to treat about 60 bushels of seed. The cost of treatment therefore in labor and material will be about 2 cents per bushel, and the benefits derived therefrom in increased yield worth double as many dollars.

LIST OF BULLETINS AND CIRCULARS

The following is a list of Bulletins and Circulars of the Illinois Experiment Station available for distribution. Any of these will be sent free of charge to any one interested in Illinois agriculture upon request to E. Davenport, Director, Agricultural Experiment Station, Urbana, Illinois. The list below includes only such bulletins and circulars as bear directly upon some phase of crop production.

Circular	No. 81.	Selection of Seed in Potato Growing.
"	No. 86.	Science and Sense in the Inoculation of Legumes.
"	No. 89.	Treatment of Oats for Smut.
"	No. 117.	Dry Rot in Corn.
Bulletin	No. 76.	Alfalfa on Illinois Soil.
"	No. 100.	Directions for the Breeding of Corn, Including Methods for the Prevention of Inbreeding.
"	No. 113.	Shrinkage of Ear Corn in Cribs.
"	No. 121.	Variety Tests of Wheat.
"	No. 126.	Distance Between Hills for Corn in the Illinois Corn Belt.
"	No. 128.	Ten Generations of Corn Breeding.
"	No. 136.	Methods of Seeding Oats, Drilling and Broadcasting.

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